

# Introduction to Traumatic Brain Injury (TBI)



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# Acknowledgements

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# Objectives:

At the end of this training you will understand:

- ✓ Definitions of brain injury
- ✓ Types and causes of TBI
- ✓ Incidence and prevalence of TBI
- ✓ Utah statistics
- ✓ Basic brain structures and functions
- ✓ Impact of TBI on the individual
- ✓ Impact of TBI on the family
- ✓ Compensatory strategies for persons with TBI

# Definitions of Brain Injury

- **Acquired Brain Injury (ABI):** an injury to the brain that occurs following birth, and can be classified as traumatic (TBI) or non-traumatic

[Educational Dimensions of Acquired Brain Injury](#), Savage, Wolcott, 1994

- **Traumatic Brain Injury (TBI):** an alteration in brain function, or other evidence of brain pathology, caused by an external force

<http://www.biausa.org/>

- **All TBIs are ABIs, but not all ABIs are TBIs**

# ABI

## Non Traumatic Brain Injury

- Involves no external force or action
- Common Causes:
  - Illness (e.g. high fever)
  - Strokes, vascular accidents
  - Anoxic injuries (e.g. lack of oxygen)
  - Brain tumors
  - Brain infections (e.g. meningitis, encephalitis)
  - Poisoning (e.g. ingestion, inhalation)
  - Metabolic disorders (e.g. insulin shock)

# Traumatic Brain Injury (TBI)

- **Open Brain Injury**

- Skull is penetrated by an external object
- Blood and swelling have a place to go

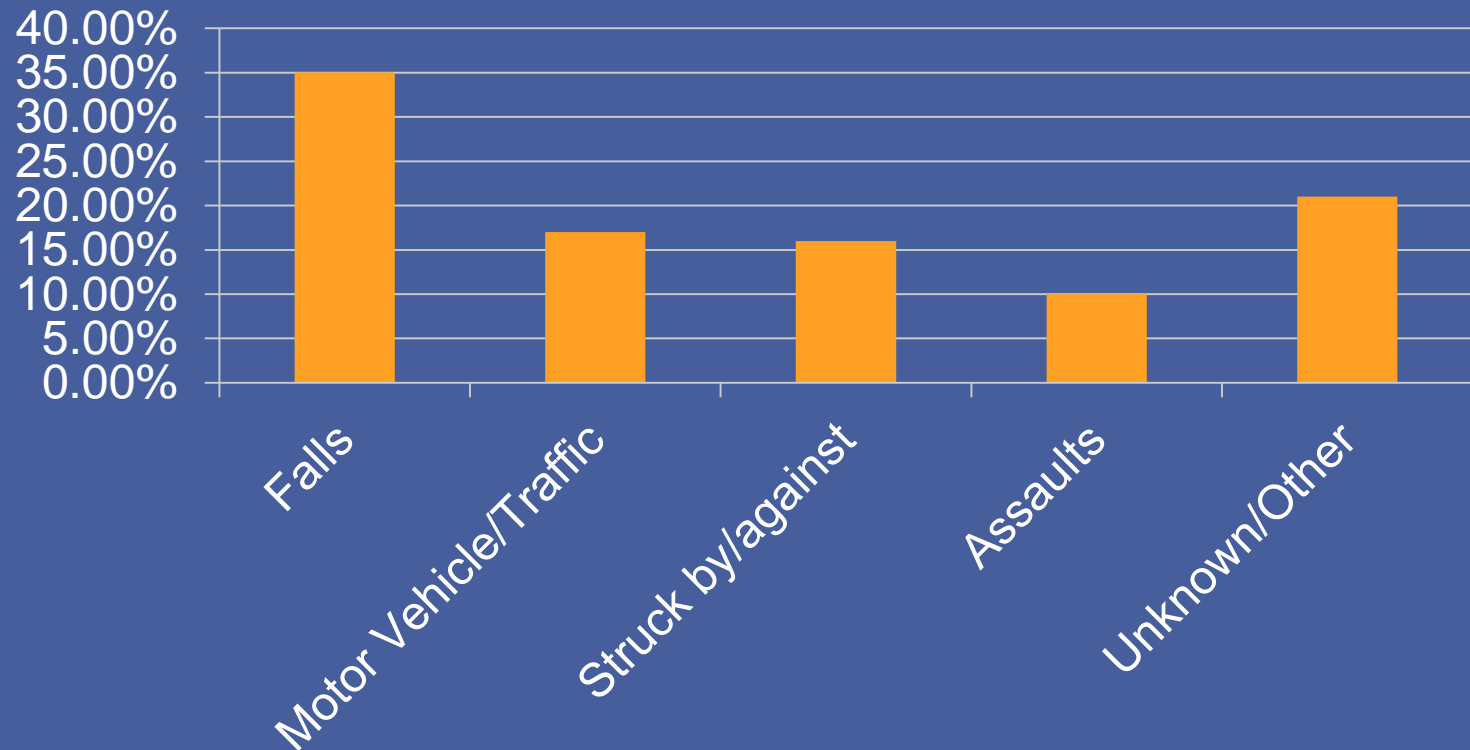
- **Closed Brain Injury**

- Concussion
- Skull is not penetrated
- Swelling results in further (secondary) injury
  - May go unidentified if no loss of consciousness
  - Damage as great or greater than open brain injury

# Mechanisms of injury

- **Diffuse Axonal Injury:**
  - shaking or strong rotation of the head
- **Concussion:**
  - direct blows to the head, gunshot wounds, violent shaking of the head, or force from a whiplash
- **Coup-contrecoup:**
  - contusions that are both at the site of the impact and on the complete opposite side of the brain.
- **Second Impact Syndrome:**
  - occurs when a person sustains a second TBI before the symptoms of the first TBI have healed

# Major Causes of TBI



Centers for Disease Control/CDC



# LEVELS OF SEVERITY

- Measured at the time of injury Glasgow Coma Scale
- Do not predict recovery outcomes
- Loss of consciousness not required for serious brain injury

# Glasgow Coma Scale

Glasgow Coma Score		
Eye Opening (E)	Verbal Response (V)	Motor Response (M)
4=Spontaneous 3=To Voice 2=To Pain 1=None	5=Normal conversation 4=Disoriented conversation 3=Words, but not coherent 2=No words... only sounds 1=None	6=Normal 5=Localizes to pain 4=Withdraws to pain 3=Decorticate posture 2=Decerebrate 1=None
Total= E+V+M		

# Mild TBI (GCS of 13-15)

- May include one or more of the following symptoms:
  - Headaches
  - Vision problems
  - Sleep disturbance and extreme fatigue
  - Sensitivity to light/sound
  - Inability to organize thoughts & activities
  - Balance problems
  - Concentration & attention problems
  - Slowed thinking & forgetfulness
  - Nausea
  - Depression and anxiety
  - Loss of sense of self

# Moderate TBI (GCS of 8-12)

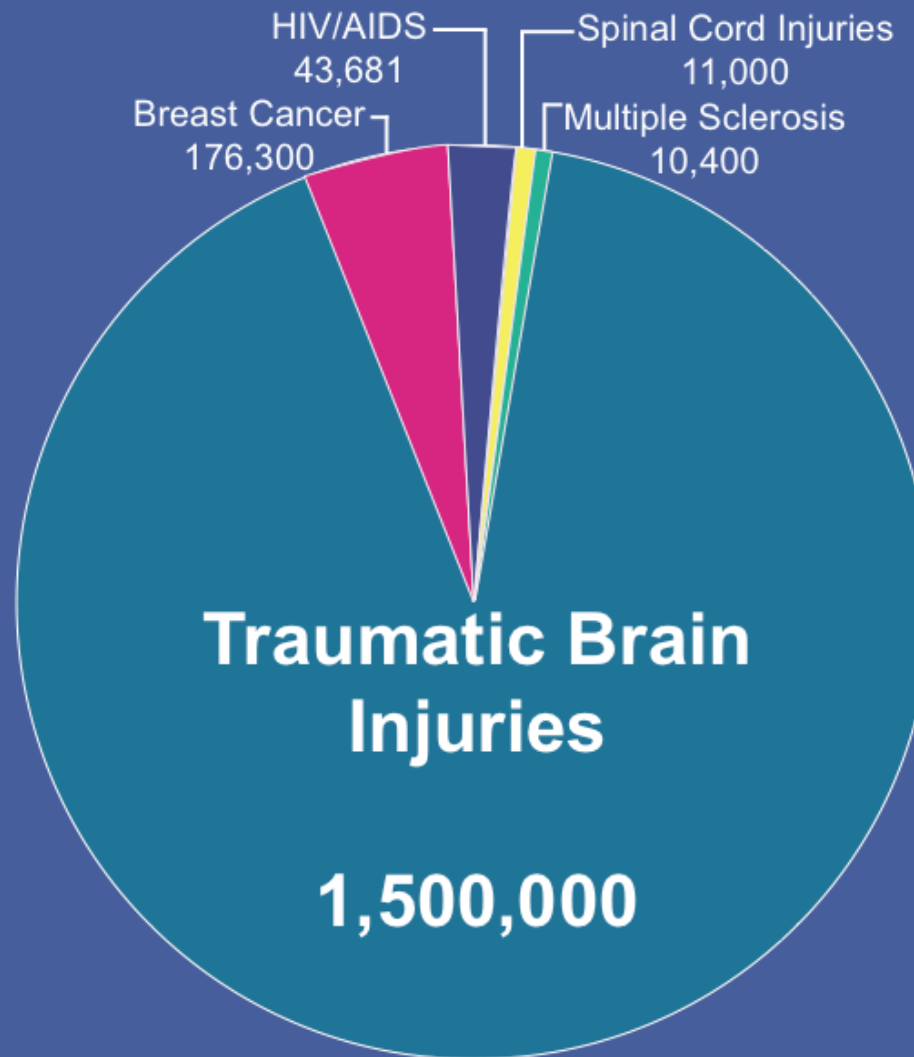
- Alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused)
- Focal neurological deficits that may or may not be transient.
- Physical, cognitive, and/or behavioral impairments last for months or are permanent
- Persons with moderate traumatic brain injury generally make a good recovery with treatment or successfully learn to compensate for their deficits

# Severe TBI (GCS Below 8)

- Almost always results in prolonged unconsciousness or coma, brain contusions, hematomas, damage to nerve fibers and axons, and/or anoxia
- Often results in permanent physical, behavioral, and/or cognitive impairments

# FACTS ABOUT TBI IN THE US

Brain Injury is a Silent Epidemic

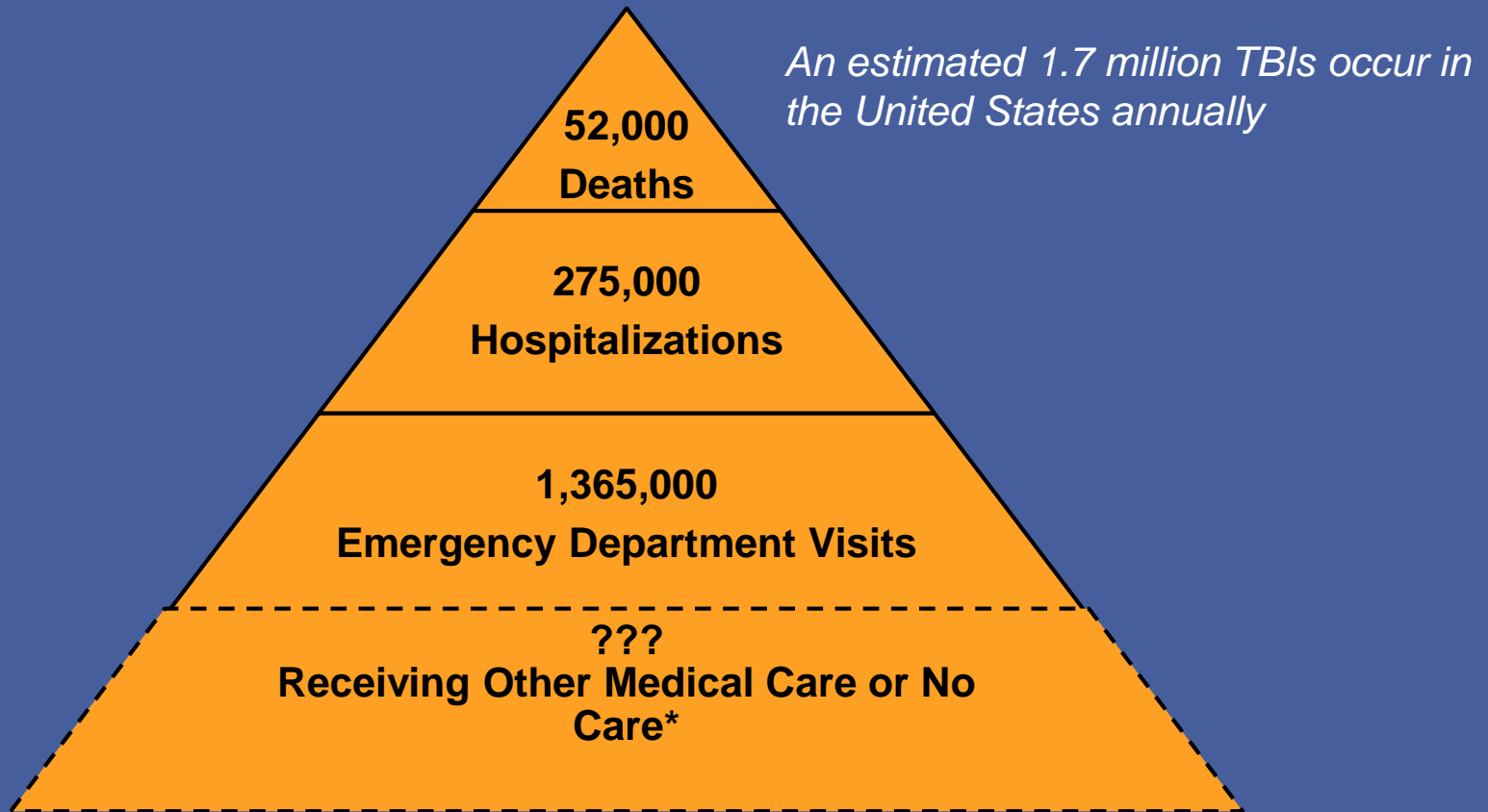


## Comparison of Annual Incidence

Data compiled by the Brain Injury Association of America based of data from the Centers for Disease Control and Prevention, American Cancer Society and National Multiple Sclerosis Society

# Annual Number of TBIs

Estimated Average Annual Number of Traumatic Brain Injury-Related  
Emergency Department Visits, Hospitalizations and Deaths, United States 2002-2006



\*The number of people with TBI who are not seen in an emergency department or who receive no care is unknown.

<http://www.cdc.gov/traumaticbraininjury/statistics.html>



# Who experiences TBIs?

- Highest risk 0-4 years, 15-19, and 65 years and older
- Higher rates for males than females
- Adults 75 and older have highest rates of TBI related hospitalizations and death
- Males 0-4 have highest rates of TBI-related emergency department visits, hospitalizations and deaths.

<http://www.cdc.gov/traumaticbraininjury/statistics.html>

If you have a brain injury, you are  
3 times more likely to get  
another. After the second  
injury, the risk for the third injury  
is 8 times greater.

# Costs to treat TBI are staggering:

- Direct medical costs and indirect costs of TBI, such as lost productivity, was estimated \$76.5 billion in the United States in 2000
- Average hospital-based acute rehab is about \$8,000 per day
- Range for post-acute residential is about \$850 to \$2,500 per day
- Day treatment programs (e.g., 4 hours of therapy) are about \$600 to \$1,000 with no room/board

[www.cdc.gov](http://www.cdc.gov)  
[www.biausa.org](http://www.biausa.org)

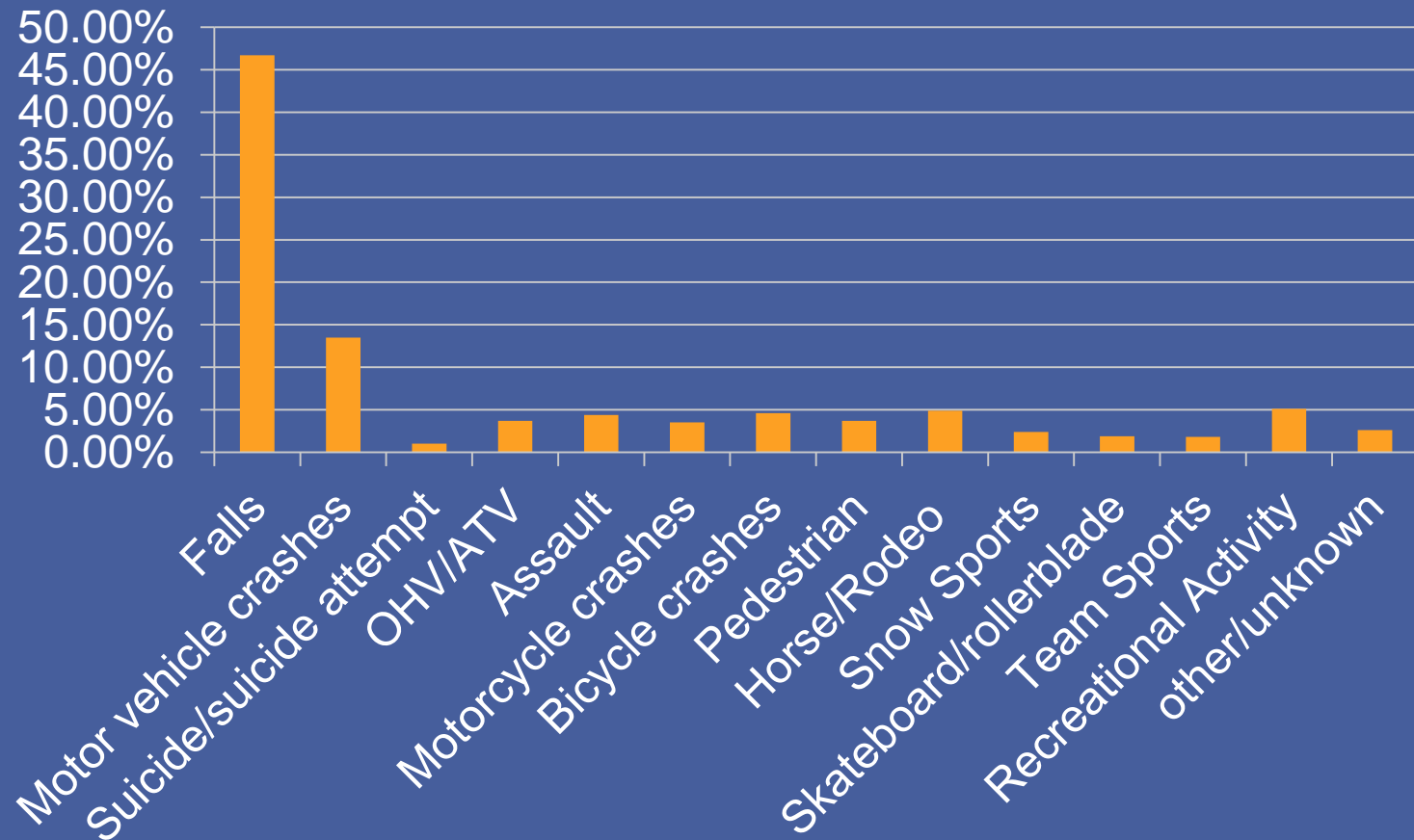
*“Since anyone can sustain a brain injury at any time, it is important for everyone to have access to comprehensive rehabilitation and ongoing disease management. Doing so eases medical complications, permanent disability, family dysfunction, job loss, homelessness, impoverishment, medical indigence, suicide and involvement with the criminal or juvenile justice system. Access to early, comprehensive treatment for brain injury also alleviates the burden of long term care that is transferred to tax payers at the federal, state and local levels”*

Dr. Brent Masel, National Medical Director  
for the Brain Injury Association of America

# The Utah Picture



# Causes of TBI Hospitalizations and Deaths, 2011 Utah



<http://health.utah.gov/vipp/pdf/FactSheets/2009TBI.pdf>

# Age Groups with the Highest Rate of TBI Deaths and Hospitalizations, Utah 2009

Age Group	Rate	Estimate
<b>All ages</b>	9.6 per 10,000 population	~1 in every 1,050 Utahns
<b>75-84</b>	33.2 per 10,000 population	~1 in every 300 Utahns
<b>85+</b>	73.6 per 10,000 population	~1 in every 150 Utahns

<http://health.utah.gov/vipp/pdf/FactSheets/2011TBI.pdf>

# TBI Hospitalizations, Utah 2012

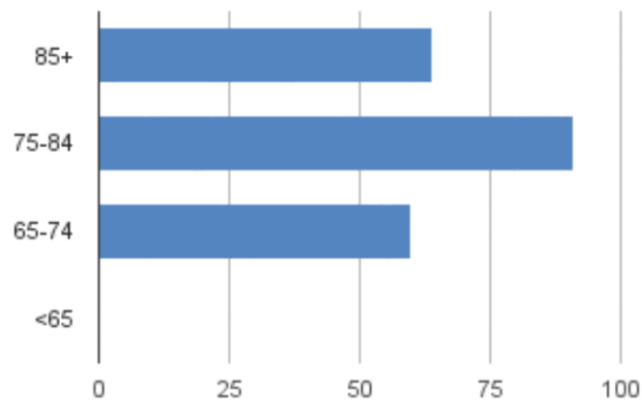
- Daily:
  - 58 people treated and released from ER
  - Another 7 are hospitalized
  - One person dies
- Yearly:
  - 2,532 people hospitalized
  - Another 544 Utahns died

[www.health.utah.gov/vipp](http://www.health.utah.gov/vipp)

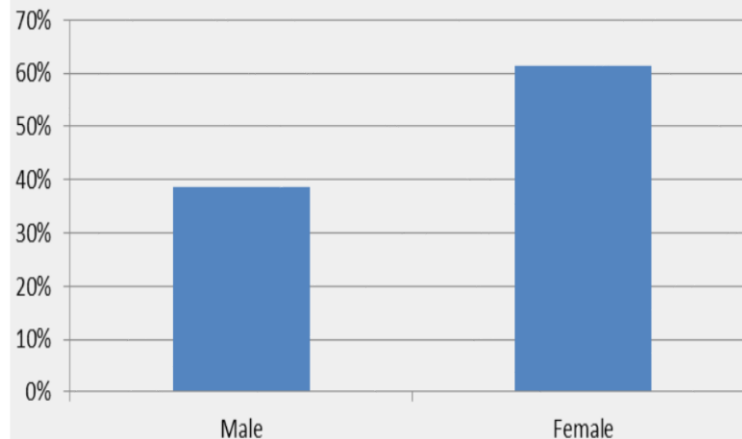


# Diabetes and TBI in Utah

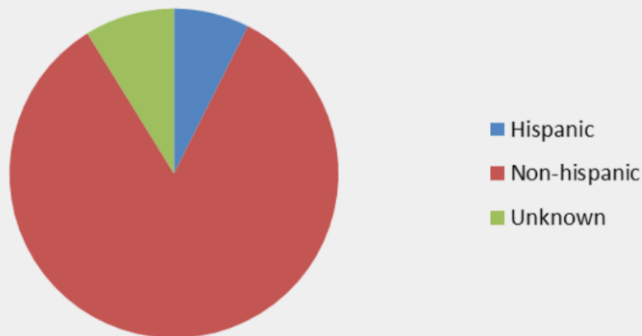
**Age Distribution**



**Percentage by Gender**

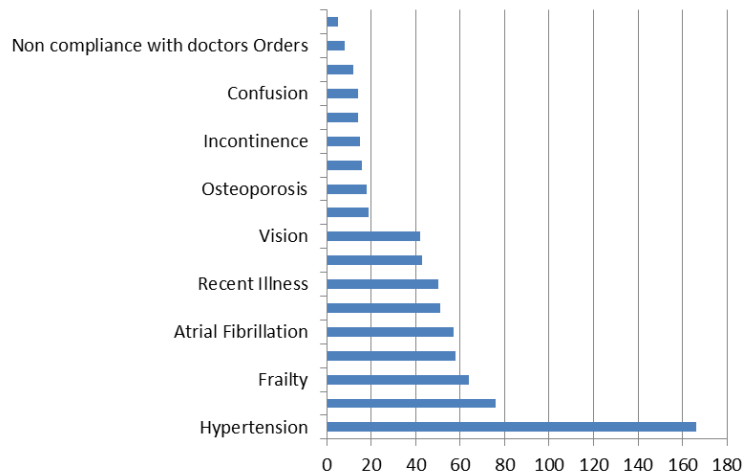


**Percentage by Ethnicity**

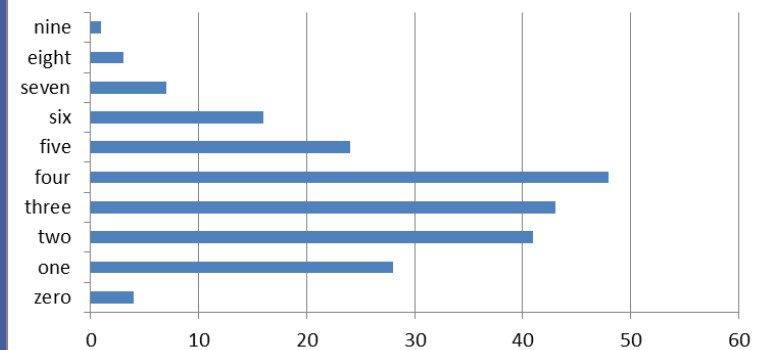


# Co-morbidity

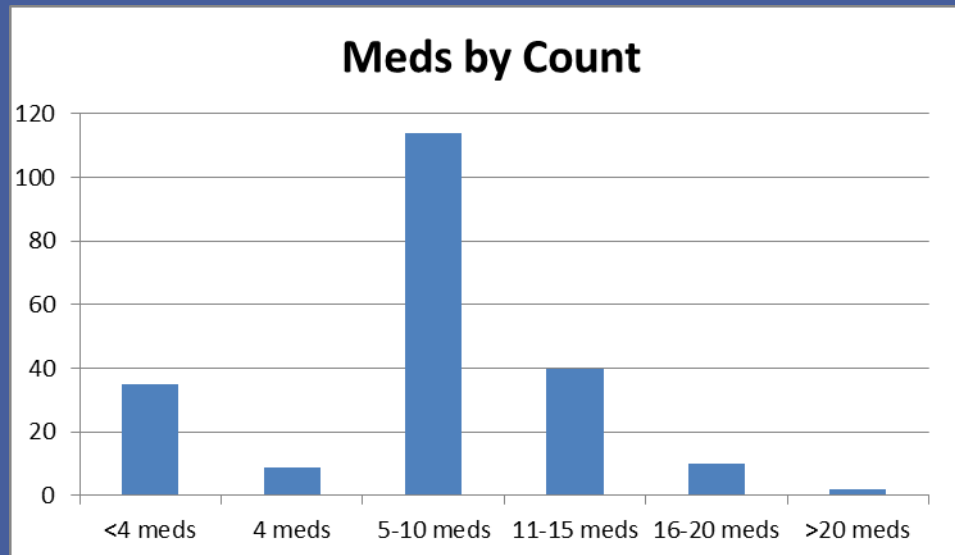
**Frequency of Co-morbid by Type**



**Frequency of Co-morbid by Count**

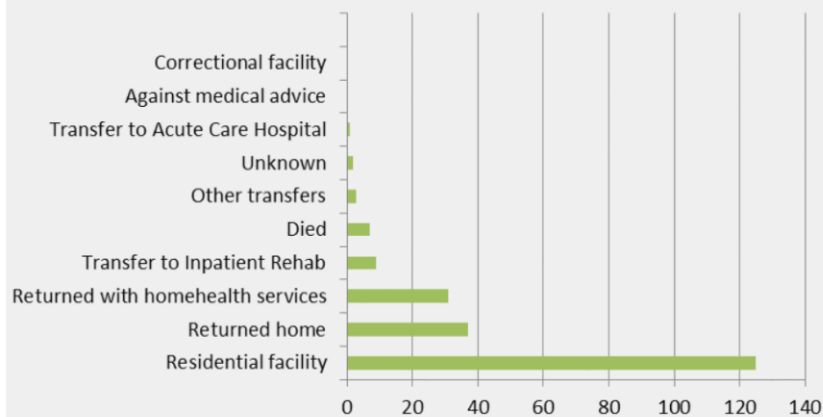


# Medication

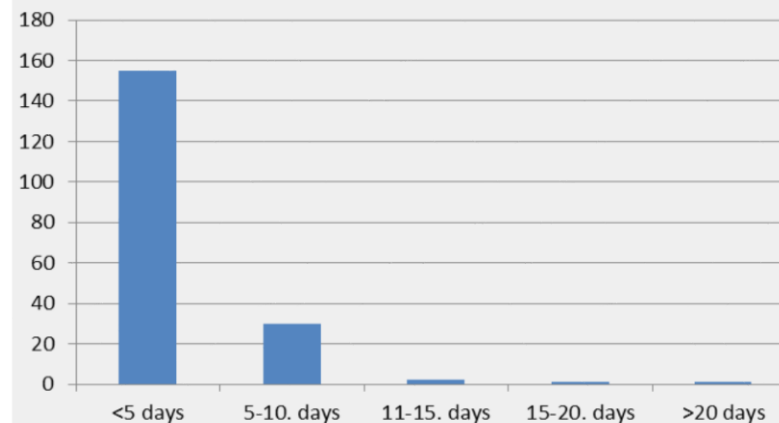


# Cost

**Discharge Disposition**



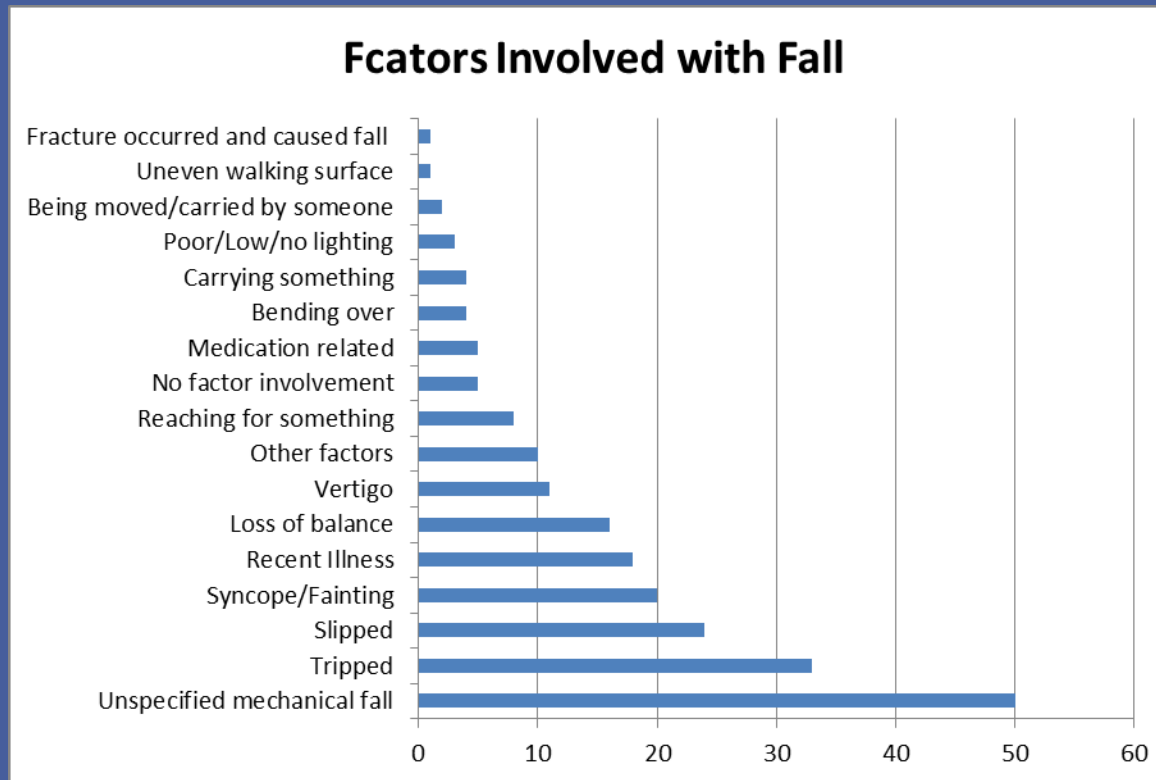
**Length of Stay**



**Total cost of Hospitalization**  
**\$5,889,874.60**

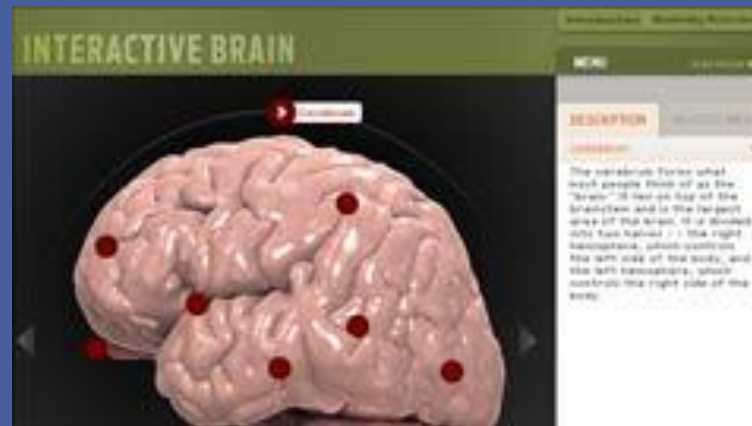
**Average Cost \$27,615.99**

# Factors



# The Impact of TBI on the Brain

- Deficits vary depending upon location and severity of brain injury
- Explore the anatomy of the brain and how it works. Traumatic Brain Injury: The Journey Home  
<http://www.traumaticbraininjuryatoz.org/The-Brain.aspx>



# “I think, therefore I am.”

René Descartes, 17th-century philosopher

- The brain: control Center for all human activity, including:
  - Sensory and motor processes
  - Thinking, judgment, emotional reactions
- Brain Injury affects not only our cognitive abilities, but also our sense of self

# Neurochemical problems disrupt functioning

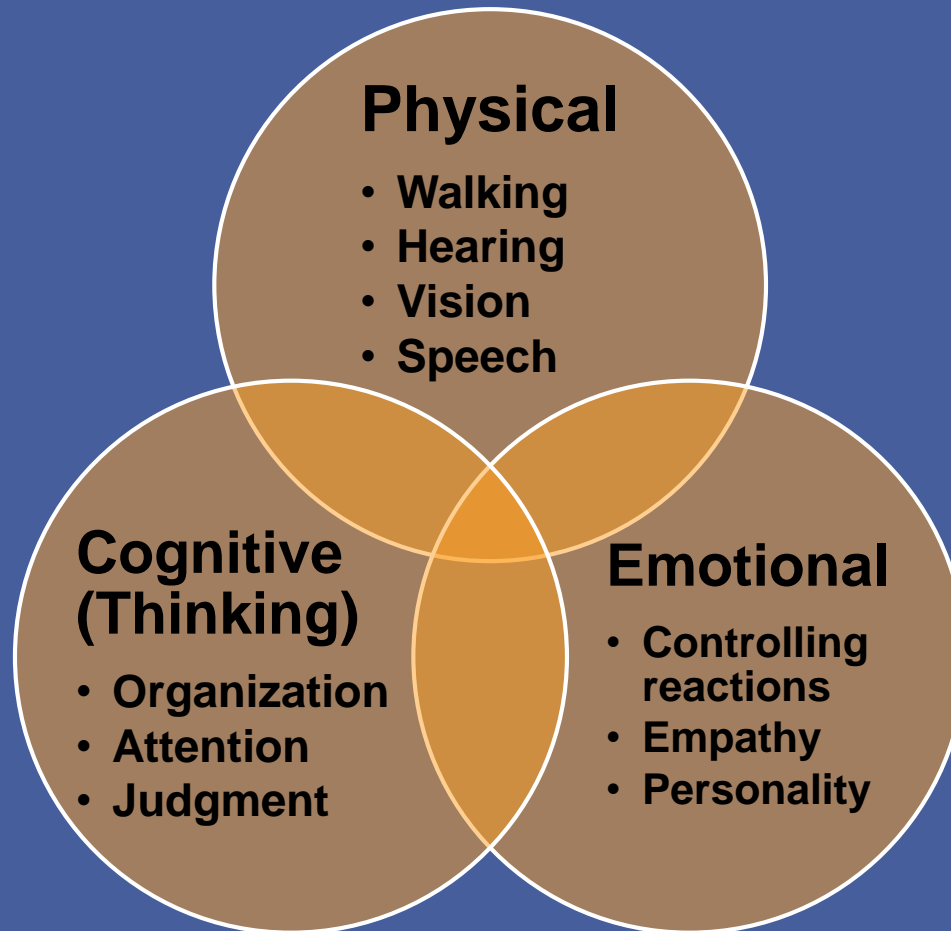
- TBI disturbs the chemistry of the brain
- Brain cannot function properly
- Can take weeks and sometimes months for the chemical imbalance to be resolved
- As chemistry of brain improves, so does the person's ability to function
- Rehabilitation sets in motion the process of adaptation and change



# Secondary Brain Injury

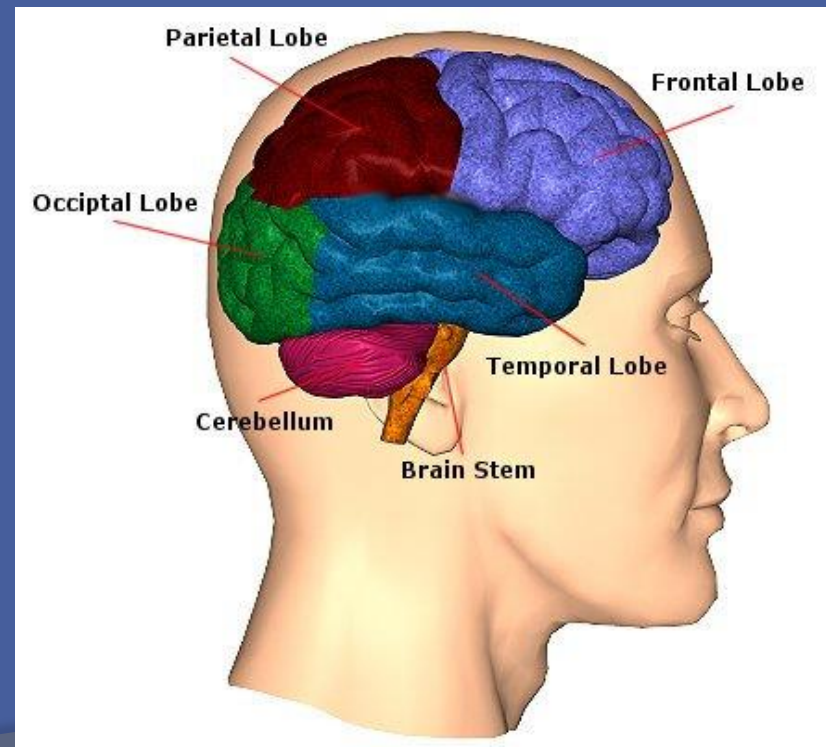
- Common Problems:
  - Brain tissue fills with fluid and swells
    - Brain has nowhere to expand as it swells because of hard skull around it.
    - Swelling causes intracranial pressure, which can further injure the brain.

# TBI may affect individual's abilities:



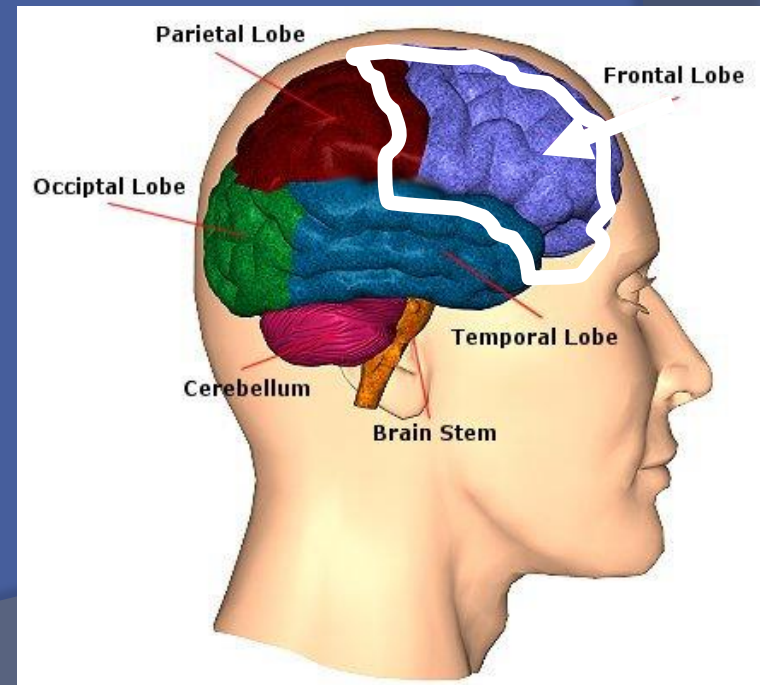
# Neuroanatomy and Physiology of the Brain

- Deficits vary depending upon location and severity of brain injury
- Major Brain Areas
  - Frontal Lobe
  - Parietal Lobe
  - Temporal Lobes
  - Occipital Lobe
  - Cerebellum
  - Brain Stem



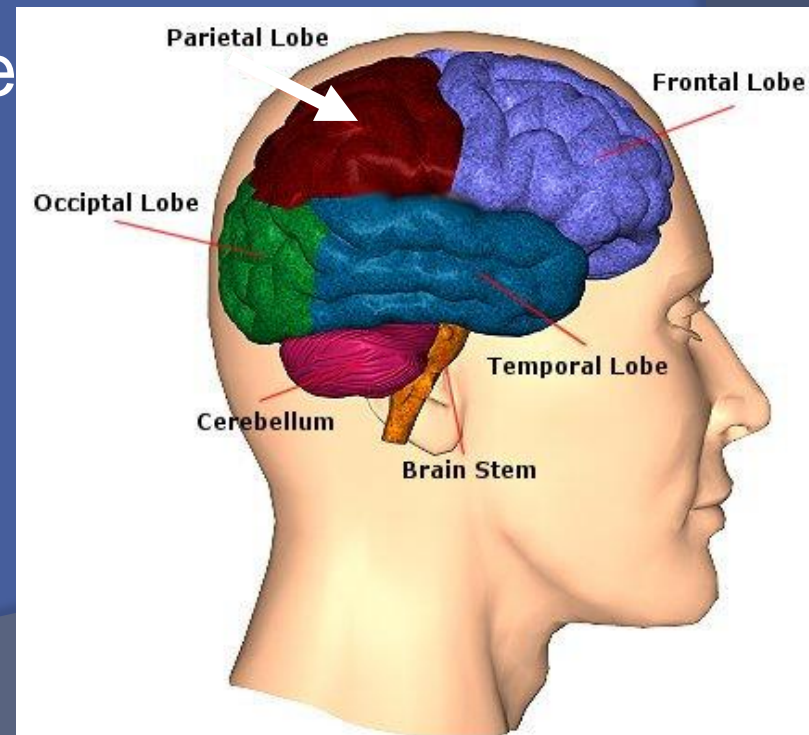
# Frontal Lobe

- Motor output
- Problem Solving
- Self-monitoring
- Expressive language organization (i.e., speech)
- Personality
- Emotions
- Inhibition of Behavior



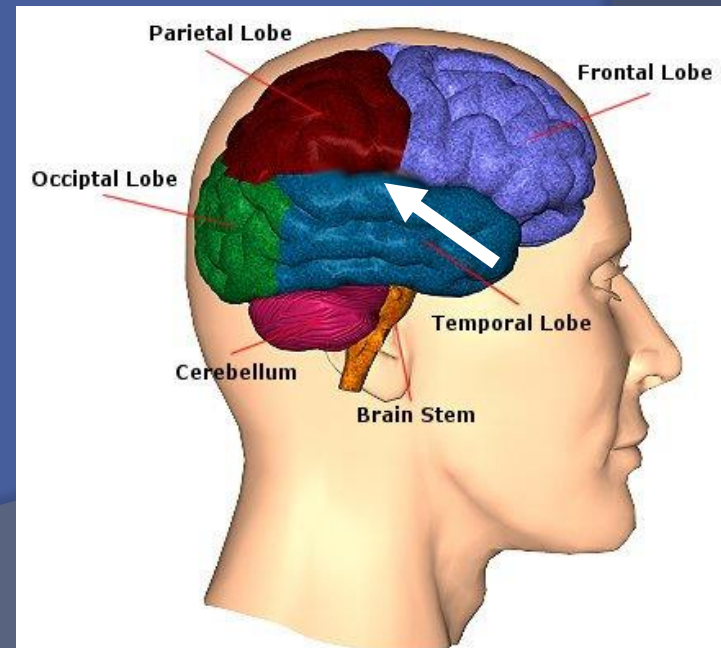
# Parietal Lobe

- Sense of touch
- Sensory integration
- Spatial perception
- Visual perception
- Identification of size, shape, color



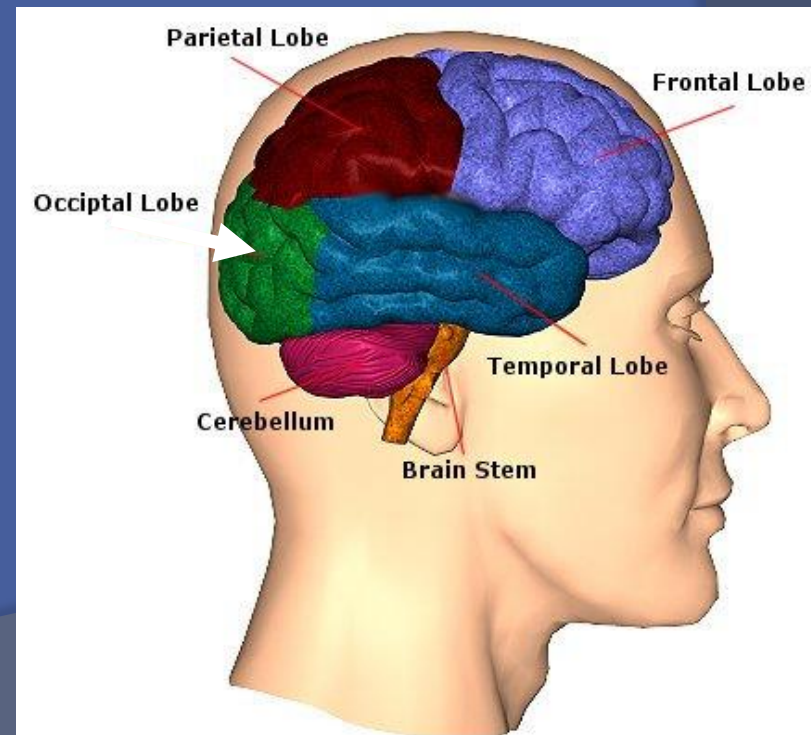
# Temporal Lobe

- Auditory projection (interpretation of speech)/Receptive language
- Memory of new information
- Sequencing
- Hearing



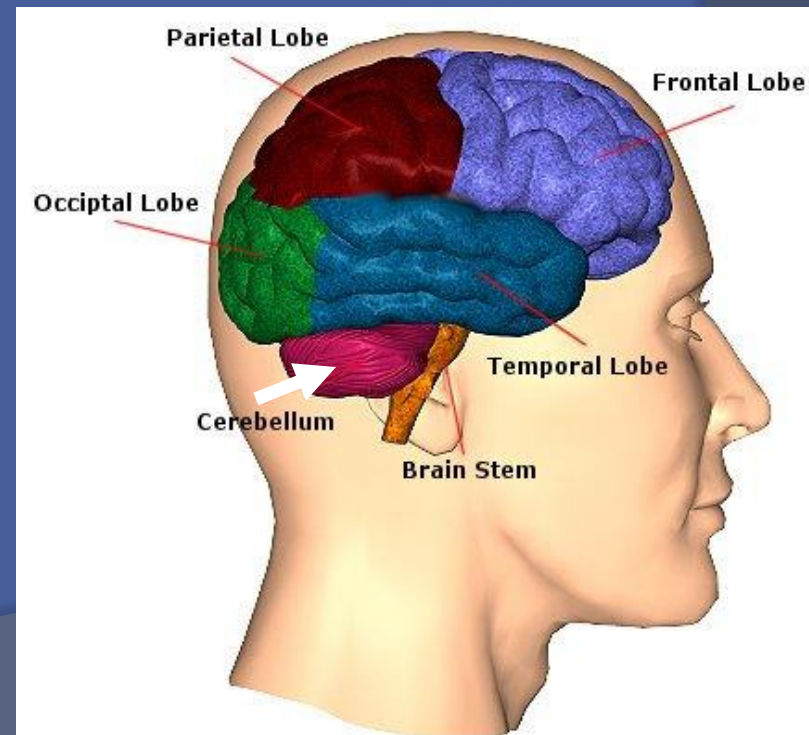
# Occipital Lobe

- Vision



# Cerebellum

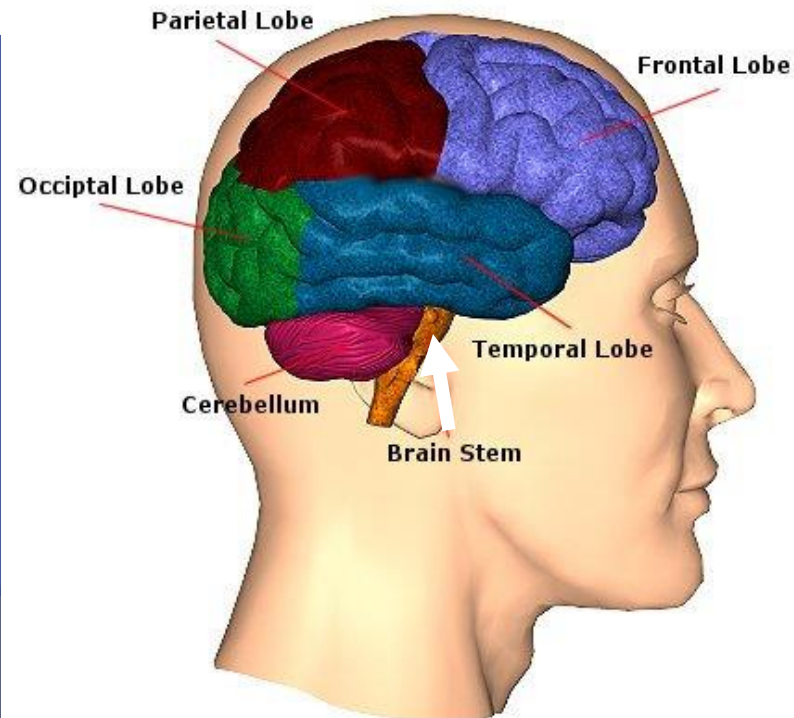
- Balance
- Coordination
- Skilled motor activity





# Brain Stem

- Breathing
- Arousal and consciousness
- Sleep/wake cycles
- Attention and concentration
- Heart rate



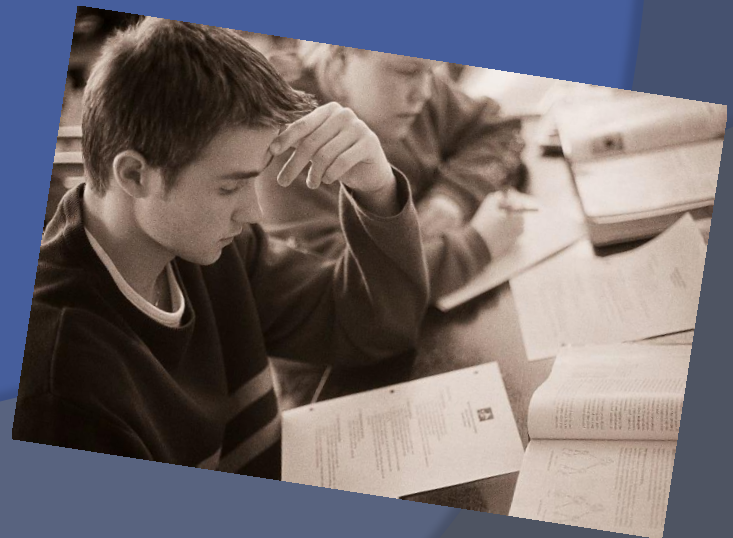
# Physical Disabilities

- Headaches
- Dizziness
- Chronic pain
- Seizures
- Decreased coordination
- Loss of limbs or use of limbs
- Nerve Damage (i.e., optic nerve, facial palsy)
- Sensory limitations (visual disturbances, hearing loss, decreased taste and smell, increased sensitivity to noise and light)



# Cognition

- Broad range of symptoms that occur independently or in combination
  - Memory impairment
  - Impaired attention
  - Inability to remain on task
  - Difficulty focusing on thoughts, words, events
  - Deficits in language use
  - Deficits in visual perception



# Cognition-Deficits in executive skills

- Inability to self-monitor and inhibit responses
- Poor initiation
- Difficulty sequencing steps and completing activities

# Cognition- Reasoning and Problem-Solving

- Difficulty analyzing situations
- Inability to draw conclusions and make decisions
- Lack of logical thinking

# Behavioral/Emotional Symptoms

- Restlessness
- Irritability
- Aggression
- Decreased motivation
- Anxiety
- Depression
- Social Withdrawal
- Acting inappropriately
- Lethargy (sluggishness)

# Social

- Difficulty attending to social cues
- Relearning appropriate social skills
- Loss of friends
- Loss of familiar activities
- Loss of self
- Personality changes
- Problems with emotional control
- Susceptible to mood and anxiety disorders
- Increased risk of suicide
- Egocentric

# Behavioral and Emotional

- Frustration
- Irritability
- Restlessness
- Anxiety
- Low motivation
- Depression





# Behavioral and Emotional

- Aggression- reactive, triggered by modest or trivial stimuli, non-reflective, not pre-meditated, non purposeful, explosive and periodic, impulsive
- Exhibits socially inappropriate behavior
- Disinhibition

# Impact on Daily Life

- TBI may affect these areas:
  - Personal care
  - Household tasks
  - Relationships
  - Work performance
  - Recreational activities
  - Transportation
  - Community navigation

# Remember the Fatigue Factor!

- Fatigue is a common problem after TBI
- Both cognitive and physical fatigue often impact multiple areas of functioning
- It takes extra effort to think after brain is injured



# Medications

- **Medications may be prescribed to help treat symptoms and side effects.**
  - SSRIs (e.g., Prozac) often prescribed for anxiety and depression
  - Anticonvulsants (e.g., Tegretol) often prescribed to prevent seizure activity or to treat behavioral problems
  - Sleep medications (e.g., Melatonin) often prescribed for sleep disturbances
  - Neuroleptics (e.g., Risperdal) prescribed for psychosis and/or aggression
- **Need for continued re-evaluation; watch for side-effects**

# Challenges of Living with a Brain Injury

- Impact on family and relationships
- Grieving
- Stress
- Rehabilitation

# Impact on Family Members

- Changed family goals and roles
- Coping with behavioral problems
- Family member with TBI struggling to adjust
- Locating supports and services
- Coping with support required to adjust to consequences of TBI

Resource: Understanding Brain Injury, A guide for the Family (Mayo Clinic )

[http://mayoresearch.mayo.edu/mayo/research/tbims/upload/ubi\\_families.pdf](http://mayoresearch.mayo.edu/mayo/research/tbims/upload/ubi_families.pdf)

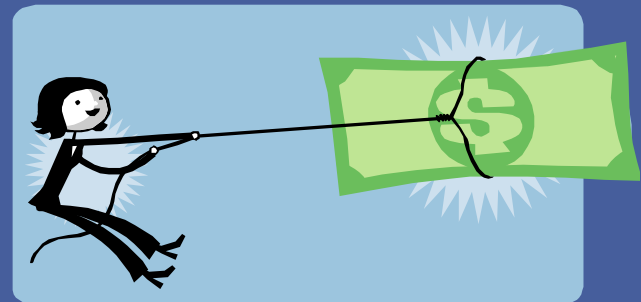
# Grieving is a Continual Process

- Denial
- Anger
- Bargaining
- Depression
- Acceptance



# Stress

- Inability to function at pre-injury levels
- Economic Strain
  - Estimates for average lifetime cost of care for a person with severe TBI exceed \$4 million
  - Financial resources begin to dwindle
- Loss of job during and after recovery





# Brain Injury Rehabilitation

- Different kinds of specialized supports and services following treatment in the emergency and early phases of brain injury treatment
- Takes a long time; it is usually measured in years

# Substance Abuse and TBI

- Substance abuse can negatively affect outcomes and increase the risk for additional injury
- Higher rates of substance abuse negatively effects 28%-32% of individuals recovering from TBIs
- Your brain is more vulnerable to a second brain injury resulting from continued alcohol and drug use

# Surviving the Challenges of TBI

- Compensatory Strategies
  - Structure the environment
  - Break tasks and instructions into component parts
  - Pace the work
  - Help develop organizational systems
    - Reminder alerts for appointments
    - Planners
    - Checklists
  - Sunglasses for light sensitivity
  - Cane for balance
  - Use Routines
  - **BE CONSISTENT!**

Handout: Cognitive Problems after Traumatic Brain Injury

# Brain Injury: Anytime, Anywhere, Anyone

- Brain Injuries do not discriminate
- You can't plan for a brain injury, but once it happens, you need to know where to go for help
- Early, equal and adequate access to care will greatly increase overall quality of life

<http://www.biausa.org/brain-injury-awareness-month.htm>

# TBI FUND

- Established in 2008 to provide
- Education to the general public and professionals on the treatment and prevention of TBI
- Access to Neuro-Psychological Evaluations
- Resource Facilitation services to people with a TBI and their families.



# Resource Facilitation

- Resource facilitation is a process that helps individuals affected by a brain injury problem solve issues and identify support resources to ensure their needs and the needs of their family are being met.



# Resource Facilitation

- Provides short-term services by a trained Resource Facilitator
- Assists families and the individual with TBI get connected to resources and supports available in their community
- Provides ongoing follow-up
- Offered state wide

# How to access Resource Facilitation

- Contact the Brain Injury Resource Line
  - 1-888-222-2542
  - [tbi@utah.gov](mailto:tbi@utah.gov)
  - [health.utah.gov/tbi](http://health.utah.gov/tbi).



# State Resources

- Brain Injury Association of Utah  
[www.biau.org](http://www.biau.org)
- Utah Dept. of Health, Violence and Injury Prevention  
[www.health.utah.gov/tbigrant](http://www.health.utah.gov/tbigrant)
- Medical Home Portal  
[www.medicalhomeportal.org](http://www.medicalhomeportal.org)
- Phoenix Services  
[www.phoenixservices.org](http://www.phoenixservices.org)
- Utah Brain Injury Council  
[www.utahbraininjurycouncil.net](http://www.utahbraininjurycouncil.net)

# National Resources

- **Brain Injury Association of America**

[www.biausa.org](http://www.biausa.org)

- **Brainline**

[www.brainline.org](http://www.brainline.org)

**Centers for Disease Control**

[www.cdc.com](http://www.cdc.com)

- **The Model Systems Knowledge Translation Center (MSKTC)**

<http://www.msktc.org/tbi/factsheets/index.asp>

Thank You